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ABSTRACT

This is a kindergarten manual for teachers using SMSG elementary school text materials. For each chapter, objectives, vocabulary, materials, and activities to help develop concepts are given. Chapter topics include: (1) sets; (2) recognizing geometric shapes; (3) comparison of sets; (4) subset; (5) joining and removing; (6) ordering; (7) using geometric shapes for directions and games; and (8) using numbers with sets. (MP)

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SCHOOL MATHEMATICS STUDY GROUP

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MATHEMATICS FOR THE ELEMENTARY SCHOOL

Book K

Teachers' Commentary

(preliminary edition)

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INTRODUCTION

People have different philosophies regarding the purpose of the kindergarten in the school, the role that it plays in the education of young children, the scope of the kindergarten program, and the way that the program should be implemented.

1963 Summer

The SMSG Writing Team found it necessary to take a position regarding such matters. Their point of view, reflected in the activities suggested, has been based on present day information regarding kindergarten children on the reports sent by the kindergarten teachers participating in the "center try-out" of materials prepared in 1962, and in recommendations made by the kindergarten teachers who were members of the 1963 writing team.

As is noted, the plan that a certain time each day be set aside for number activities was not taken. Neither was the use of pencil and paper activities endorsed. However, many have found it helpful to designate some time each week when the development of one of the ideas suggested in the activities can be begun. These ideas continue to be developed informally through the familiar ongoing activities in the kindergarten classroom.

Teachers using these materials this year are asked to follow the order of development of parts as given. However, some phases of each activity may be delayed until some later date when it is possible to make use of succeeding ideas, and when children are more mature.

Obviously, it is not possible for us to put all suggested activities in contextual setting. We ask you to supplement the suggestions made with those that are particularly appropriate for children in your kindergarten. Too, we encourage you to adapt any activities suggested if such adaptations are more suitable for your children and your particular program, but in keeping with the objectives given.

Deliberately, we have used the word "set" almost to the exclusion of other words, such as group, bunch, collection, etc. This has been done to illustrate the wide variety of situations to which the term can be applied. However, do not conclude that it was our intention to suggest that words such as groups,

bunches, etc., not be used. They should be used when it is natural to do so.

Also, we encourage you to bring in the use of terms naturally. Just because we suggest, "Will the se of boys in our class stand," don't think you should always say this. Sometimes it is most natural to say, "Will the boys stand?" In brief, you can try so hard to use these terms in other activities that it may become too artificial.

Report forms will be provided for you. We hope you will share your reactions to the materials as developed, the ways in which you made use of them, and your comments and suggestions for improving them. Your recommendations will be given serious consideration in making plans for revisions.

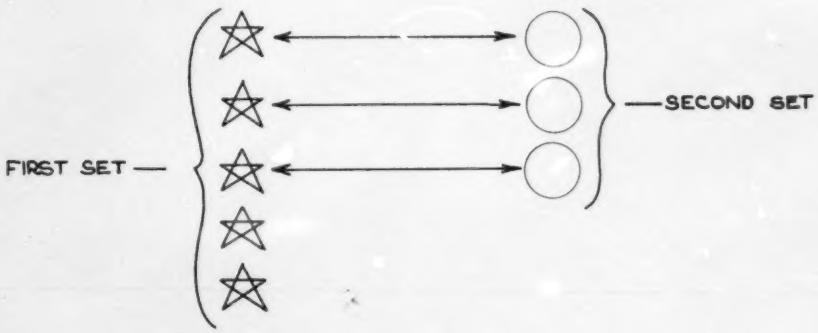
Background for Teachers

Sets. A set is simply a collection of things. The things belonging to a set are called its members. A set may be defined by some property common to its members (the set of all books on this shelf; the set of all children in this room). Sets may also consist of quite unrelated objects and may be defined by simply listing their members, as in the set whose members are a certain boy, a certain book, and the moon.

It is possible for a set to have only one member. For example, the set whose only member is the teacher of the class, or the clock on the wall, or the classroom piano. There is also one special set called the empty set, which by definition has no members at all. For example, the set of all elephants in the classroom is the empty set.

One set is a subset of another if every member of the first set is also a member of the second. Thus the set of girls in a classroom is a subset of the set of children in that classroom; and the set of all tricycles is a subset of the set of all toys. There are two tricky special cases of the definition of subset. First, any given set is a subset of itself (because it fits the definition of subset: every member of a given set is also a member of that set!) Second, the empty set is a subset of every set, because all the members of the empty set (There aren't any!) belong to that given set.

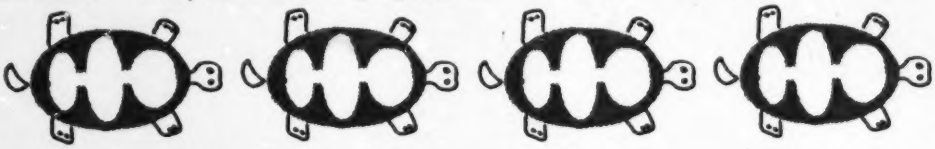
Comparison of Sets; Numbers. We can compare two sets by pairing the members of one set with those of the other. Example:



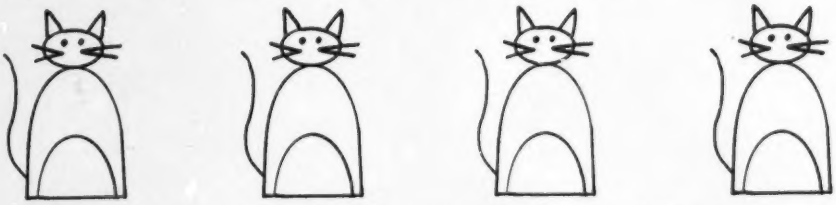
In this example there are members of the first set left unpaired with members of the second, so the first set has more members than the second (and hence the second has fewer members than the first).

When such a pairing process "comes out even," so that there are no members left over in either of the two sets, we say that the two sets have been placed in one-to-one correspondence and that they are equivalent.

When two sets are equivalent we say that they have the same number of elements. The number of elements in a set is the property shared by all sets equivalent to it. Thus, four is the property of all sets equivalent to



or to:



We see from the pictures above that the set of cats is equivalent to the set of turtles -- it is easy to set up a one-to-one correspondence between these sets. However, these two sets are not equal. A set of cats is a very different thing from a set of turtles. The number of cats is equal (not equivalent) to the number of turtles.

When one set has more members than another, we say that the number of members in the first set is greater than the number of members in the second (and hence, of course, that the number of members in the second set is less than the number of members in the first). Thus the ideas of more than and fewer than for sets lead to the ideas of greater than and less than for numbers. The relation of fewer than (or more than) permits us to rank or order several sets of different numbers of members, the set with the fewest members coming first, the set with the next-fewest coming next, and so on, the set with the most members coming last in order.

Joining and removing sets. To take a set and join to it a second set means to form a new set whose members are all those of the first set together with all those of the second. This new set is called the union of the two given sets.

Example:

First set:	a, b, c
Second set:	p, q
Union:	a, b, c, p, q

In this example, the first set and the second set happen to be disjoint: that is, these two sets have no members in common. When this happens, the number of members in the first set plus the number of members in the second is the number of members in their union, so, we get the addition fact

$$3 + 2 = 5.$$

Thus, the joining of disjoint sets serves as an approach to the adding of numbers.

In the same way, removing from a given set one of its subsets serves as an approach to subtraction. Example:

Given set:	a, b, c, p, q
Subset removed:	p, q
Remainder set:	a, b, c

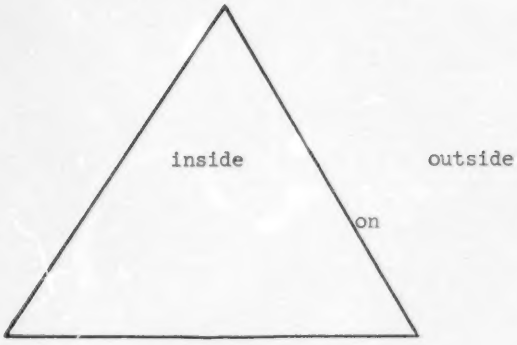
Here the corresponding subtraction fact is

$$5 - 2 = 3.$$

Geometric shapes. We wish to lead children to recognize that certain very simple geometric figures are suggested by many objects which they see and use every day. These geometric figures are: circles, triangles, and rectangles (including squares as rectangles of a special kind).

When we show children circular, triangular, or rectangular pieces of construction paper (or flannel or metal, etc.), we point out that it is the edge or border that determines the shape; and it is the figure suggested by the border only that we call a circle, or triangle, or rectangle. To emphasize this point we sometimes use models of circles, triangles, and rectangles made of wire (or of pipe-cleaners or starched string, etc.).

We would like children to be able to distinguish and describe points or locations according to whether they are inside, outside, or on a given circle, triangle, or rectangle:



We also lead children to see that a circle is round or smoothly curved, while a triangle has 3 straight sides and 3 corners, and a rectangle has 4 sides and 4 corners.

The only other distinction we try to convey is that of size: when it is that one circle is larger than or smaller than another; when one side of a triangle or rectangle is longer than or shorter than another; etc. Recognizing objects as being the same in size or length demands closer discrimination and comes later.

I-1. Sets

Objectives: To introduce the set concept and the use of set terminology, including the idea that a set may have only one member or even no members at all.

Set concepts can be effectively developed when the vocabulary is used incidentally (but reasonably naturally!) throughout the school day. Informal situations occur where reference can be made to particular sets of objects and their members. For example, "Billy, please put your set of blocks away. Children, will those of you who have blocks that belong to Billy's set, put them back." Michael lines up with the set of boys because he belongs there or is a member of that group. As the school year progresses, set descriptions should become more explicit. Instead of referring to the set of blocks in general, you may want to refer to the set of small blocks on the bottom shelf. The need for more exact descriptions may be better understood from the following example:

If a child is asked to bring you the set of red pencils on your desk, a specific set of pencils is identified. If asked to bring a set of red pencils, he may return with any set of red pencils in the room.

After "set" and "member" have been used informally for a period of time, children may be lead naturally to the idea that a set may have only one member or even no member at all. A familiar example of one member set is the set whose only member is the piano in the room (or the teacher of the class, or the clock on the wall, or the classroom American flag). As for sets with no members, make reference to such "amusing" sets as the set of elephants in the room or the set of lions at the store. Also, you may refer to sets such as the set of crayons in an empty crayon container.

Vocabulary: Set, collection, member, set with one member, set with no members.

Materials: A variety of set materials, such as: books, cars, trucks, blocks, pencils, crayons, sheets of paper, paint brushes, scissors, game boxes, puzzles, beads, paper clips, pegs, balls, play house furnishings, etc.
A variety of flannelboard objects: animals, fruit, stars, trees, storybook characters, stick figures, geometric shapes (circle, triangle, rectangle, square), etc.

Magazine pictures of collections: family, automobiles, telephones, clothing, food, toys, planes, trains and any other appropriate illustration.

Story book about a family and others for making set references.

Activities to help develop concepts:

Set: Since the children are familiar with the playhouse in the classroom, this may be used as a point of departure for iiscussing sets. In particular, the set of dishes may be most meaningful. Arrange the playhouse table and chairs in front of the children's seating area. Have the set of dishes, the set of silverware, and the set of glasses or cups available. These questions can be used as a guide:

How many children have helped to get the table ready for dinner?

What do you put on the table? (plates, glasses, silverware, etc.)

Yes, we put a set of dishes, a set of silverware and a set of glasses on the table. Let's pretend that we're going to have dinner and need to get our table ready.

Jamie, will you put the plates on our table? Does each plate belong to our set of dishes? (Yes)

Johnny, what would you like to put on the table for us? (possibly the silverware) The set of silverware is on the table now. Ask if a particular knife or fork or spoon belong to our set of silverware. (Yes)

Angie, what set do we have left? (set of glasses) Will you please put these on the table?

Now, is our table ready for dinner? (Yes) What about our people to eat the dinner? Can we call this a set too? (Yes) Name 4 children to be members of the set who are to eat at the table. You might ask if other children are members of the set named to eat.

Culminate discussion by identification of other sets in the playhouse, at home, etc.

Member of a set:

Select a story about a family and read this to the class. Some suggestions are listed below:

Flack, Marjorie; The Story of Ping
McCloskey, Robert; A Day in Maine; Make Way for Ducklings; Blueberries for Sale
Ward, Lynd; The Biggest Bear
Zion, Gene; The Plant Sitter
Traditional: Goldilocks and the Three Bears; Little Red Riding Hood; Cinderella; etc.

After reading the story, have the pupils describe various sets in it. Further attention can be focused upon the things that belong to each set. The sets may range from the set of buildings on a particular street to the set of people or animals about whom the story is written. Draw the discussion to a particular group of people or animals in the story. Make reference to this group with the following questions or statements.

> Today we read a story about a family. The family was a group of people (animals, etc.). Is that a set? (Yes) Who were the members of this set? (Use flannelboard materials or pictures corresponding to the members in the story for reinforcement.)
>
> Yes, all of these are members of the set of people in our story. We say that each person or thing that belongs to the set is a member of the set. You children are members of our class. You belong to the set of children in our class. Some of you belong to church groups. You are members of them. You are members of the set of children who come to our school. Identify a particular set of toys and name the members of the set identified. Make as many references as needed to help clarify the meaning of member of a group or set.

Talk further about the sets previously discussed, identifying the members of these sets (e.g., the set of dishes in the play house; each plate, each cup, and each saucer, etc., is a member of this set). Then ask if the table is a member of the set of dishes. Point out that somethings are not members of some

sets. For instance, the books are not members of the set of paint brushes. Steve is not a member of the set of girls, the trucks are not members of the set of blocks, etc.

Set with one member:

> Today let's have all the girls wearing red dresses stand. (Continue with a variety of set descriptions.) (The teacher should be seated.) Now, will the set of boys stand? (Be seated.) Set of girls stand? (Be seated.) Set of teachers stand? (Reactions at this point should appear from the class.) Yes, I am the only member of the set of teachers in this room (assuming that there is not more than one teacher). Can you think of any other sets in our room with just one member? (The set of pianos, the set of teacher's desks, the set of goldfish, etc.) Sets can have more than one member, such as the set of children in our school; or the set of children in our classroom. Sets also can have just one member. Is the set of record players in our room a set with one member? (Yes) Discuss other sets which have just one member such as: the set of swimming pools at a particular city park; the set of principals at your school.

Sets with no members:

On the day of this discussion the teacher might wear a piece of clothing containing at least one pocket. It should be empty. (The childre will search this pocket for a set of things.) Before the activity, select as "secret helpers" at least three children who have clothing with pockets. Place some small objects in a pocket of each child's clothing. Tell them that they will be asked to empty their pockets when the game begins. After the class is gathered together, call the "helpers" up, one at a time. Inform the children that the pockets contain surprise sets and ask them to describe the set as it is placed on the table. The following may be helpful:

> Bruce, will you please empty your pocket for us?
>
> Let's look at the things Bruce had in his pocket. What are the members of this set? (Paper clips, jacks, beads, etc.) Are there any more things in your pocket, Bruce? (No) Your pocket is now empty.

Repeat the above for each child previously chosen. Make it amusing and fun for the children by using the game idea. After each child has emptied his pocket, select one child to come up and empty the teacher's pocket.

> What are the members of the set of things in my pocket?
> (No members)
>
> You mean my pocket is empty. There is nothing in it. This helps us to think about a set with no members.

See if children can suggest other sets with no members, but do not be concerned at this time if the idea needs further development.

The following activity may be used as a variation of the previous one. Whereas the first procedure actually involved the removal of the sets from the pockets, the following is a game of "pretend."

Before the class period, prepare four boxes instead of pockets. Select three children and tell them that each is to pretend that the things in the box given him were things that came out of his pocket last night. The fourth box is empty; representing the teacher's pocket.

> We are going to pretend that each of these boxes contains the things that Mary, Michael, Kathy, and I removed from our pockets last night. Mary, show the class the set of things you had in your pocket. (e.g., doll dress, paper clips, bobby pin, and eraser.) What are the members of Mary's set? (Class describes.) Things found in the other children's boxes are described in a similar way.
>
> Now, let's see the set of things I had in my pocket last night. Mark, describe the members of this set. (Child finds teacher's box empty.) What did you find, Mark? (Nothing, no members, etc.) You mean my pocket was empty? I guess I had nothing in my pocket last night.

General Activities:

1. Art activity: Have children draw pictures of sets and organize their own "Set Scrapbook." These may be used to discuss sets, members, etc. Give free choice of sets to be pictured. If suggestions are requested, they

may include: storybook family, child's own family, toys, things in his garden, his pets, etc.

2. Discover sets found in the room and describe these using the terms: set, member, etc. (e.g., sets of chairs, tables, paint brushes, crayons, science table displays, game boxes, cars, trucks, blocks, puzzles, etc.)
3. We have many toys in our room. What did we just learn we can call all of the toys? (set or collection.) Look at our set of toys. What toys do you see? (e.g., trucks, cars, dolls, etc.)
   Michael, will you show us your favorite set of toys in the room? (e.g., trucks) Oh, you like the trucks. They are fun, aren't they? Show us each member of the set of trucks.
4. The daily calendar work can be used in conjunction with the vocabulary introduced. (e.g., the set of days in the week, the set of days we go to school.)
5. Initiate a class project of creating a science table display with collections of rocks, sea shells, leaves, butterflies, etc.
6. Preparation for work period: When selecting or assigning work areas, separate the children according to sets. (e.g., set of children who wish to paint, etc.) Note: at a later date this experience may be used for "pairing" pupils with easels, paper, etc.
7. Various times occur when the teacher must use helpers, send children on errands, have children checked by the nurse, dismiss for activities, get up from rest, etc. When appropriate, refer to groups such as the set of girls with red dresses, the set of boys with jeans, the set of girls who are wearing hair ribbons, etc.
8. Prepare "surprise boxes" which contain different objects. The children can sort these objects into sets and describe the members of the sets. These boxes may be used to develop other concepts in the future; e.g., boxes of buttons may contain several different colored buttons. The children may sort these into sets of each color.
9. Sorting objects into sets. Some suggestions include:
   various size bells, boxes, books, balls
   cans, etc.
   play fruit and food
   rocks
   sea shells
   magnets
   flannelboard materials
   cards of different colors

10. Make perception cards from magazine illustrations. Show these to the class and have pupils describe the set members. Children may enjoy making their own cards.
11. Display sets from the wooden stand-up figures in the classroom; e.g., farm animals, wild animals, community helpers, etc.
12. Read stories about people, animals, things, etc., and describe the sets.

Games:

"What's Missing." Place several sets on a table -- books, blocks, cars and scissors. Ask one child to describe the sets:

> Lori, can you describe these sets for me? Yes, a set of books, a set of blocks, etc. Now turn around and we're going to remove one of these sets. (Remove set of books) Look at the table again, Lori. Can you tell us which set is gone? (set of books)

This game can be varied by selecting different objects for each game, such as ceramic figures, geometric shapes. The class may also enjoy preparing the sets and directing the activity.

I-2. Recognizing Geometric Shapes

Objective: To lead children to recognize simple geometric figures (circle, rectangle, triangle) and to use correctly the geometric terms "inside," "outside," and "on."

As the child becomes more and more aware of his surroundings, he should begin to notice various geometric shapes and to talk about them. Balls, blocks, boxes, cans, etc., will be used in everyday work and play experiences, and the child may be helped to describe these.

Early in the year, the teacher should provide many opportunities for the children to handle, observe, and talk about objects that are models of three dimensional shapes.

The child will be handling models of two dimensional objects also. Each object can be named according to the form it suggests: rectangle, circle, etc. From time to time the teacher should emphasize that the terms "circle," "rectangle," and "triangle," refer to the edges of the shapes. She may use many incidental activities in which the child is asked to run his finger around the shape under discussion, and the meanings of the terms inside, outside, and on can be introduced at this time.

Vocabulary: Circle, rectangle, triangle, square, inside, outside, side, corner

Materials: Geometric chapes made from wire, starched string, sandpaper, construction paper, and felt or flannel: oatmeal box tops, rectangular and square box tops; triangle from rhythm instruments; rings; embroidery hoops; cookie cutters; blocks; kindergarten beads; macaroni

Activities to Help Develop the Concepts:
Circle, Rectangle, Triangle, and Square:

Display models of circles. Ask if anyone knows the name of the shape. Supply name if necessary. Have children run their fingers around the models. Ask children if they can find objects in the room that are "shaped like a circle." Ask if they can tell about objects outside the classroom that are shaped like a circle.

Similar activities can be planned using models for rectangles, triangles, and squares. Models for rectangles can be made from wire or from starched string. There will be many objects in the room that are "shaped like rectangles." Whenever possible, reinforce the idea that the term "rectangle" refers to the edge of the shape about which we are talking.

Triangles can also be made from wire or from starched string. Also, triangles from the rhythm instruments and the triangular shaped blocks from the set of blocks can be used.

The square should be introduced as "a special kind of rectangle that we call a square."

The geometric shapes cut out of sandpaper help reinforce the "feel" of the shape for some children.

In a bag, place geometric shapes (square, rectangular, triangular blocks and a round wooden wheel.) Hold a newspaper between a child's eyes and hands. Ask him to reach in, pick out one object, feel it, and tell what shape he has. This same procedure may be changed by asking the child to feel for and pick out a designated shape. Wire shapes and those made out of oaktag might be substituted for the blocks.

Before the children come into the room put different sized models of circles, rectangles, and triangles (blocks, boxes, felt cutouts, oaktag cutouts, etc.) around the room. When the children are seated, hold up an object shaped like a circle, have the children identify it, and give them three minutes to see how many objects shaped like a circle can be found. Hold up another geometric shape and the game proceeds as before. Continue until all three shapes are used. You may wish to use three-dimensional shaped figures too -- balls, boxes, etc., shaped like models of prisms, spheres, and cylinders.

From where they are seated, have the children visually check to see that the right shape has been found each time.

"I'm Thinking Of" --

I'm thinking of something in this room. It is shaped like a triangle and is made of wood. What is it?

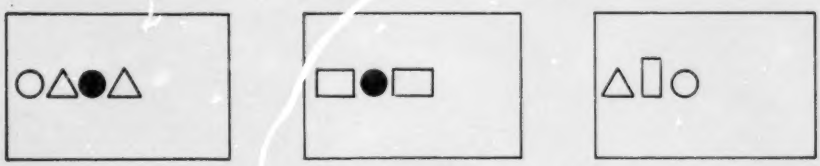
I'm thinking of another shape that has three sides and three corners but this one is made of metal. What is it?

I'm thinking of something that is shaped like a rectangle. It is made of metal. What is it?

Reserve one section of the bulletin board for display of geometric shapes.

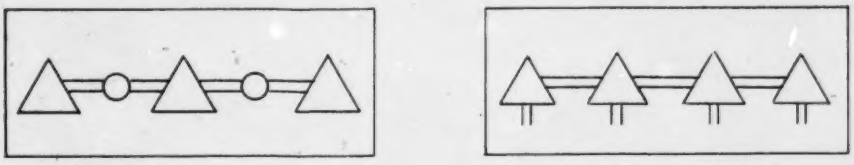
Give the children seven colored paper disks of the same size to arrange in designs. Some will be delighted to find that if six are arranged in a ring, there will be room to fit the seventh in the center. Some children will enjoy pasting colored disks of various sizes on sheets of manila or newsprint to form designs.

Using geometric shapes, start various patterns on the flannelboard, and have pupils complete them, e.g.



Form similar patterns using kindergarten beads, macaroni, straws, etc.

Cut various shapes from colored construction paper and have children paste them on a larger sheet to create a pattern design. For variety, these can be done on long rectangular pieces of construction paper.



Inside, Outside, and On:

When a child looks for an example of, say, a rectangle in his environment, he is most likely to find models such as the base of a block, or a cupboard door. These models show not only the rectangle but also its interior. The fact that the edge of the object represents the rectangle must be frequently stressed, and the words inside the rectangle and outside the rectangle should be used often. The idea of on the rectangle is by no means obvious to children, who are likely to think of on in the sense of "on top of" a table. A picture frame or the frame of a flannelboard, placed on a flat surface is a better model of a rectangle than is the cupboard door, but perhaps not as readily available for observation.

Using string or yarn make a ring (or checker or domino) on the floor. Each child will be given a marble as he is seated around the ring. From where he sits, or kneels, he gently rolls his marble toward the ring. As his marble stops, he calls out its position on the curve, "inside," "outside," or "on." After each child has had his turn, have all the marbles "outside" put into one set, those "on" into another set, and those "inside" into the third set. (Later in the year after a study of comparison and order, children can decide which set has the most members and which the fewest. These can then be ordered with the set with the fewest members on the left, the middle set next, and the set with the most members on the right. Pairing can be used to decide the order if there is any doubt.)

The concepts of inside, outside, and on can be strengthened by "Let's Pretend" games using children and objects. With a hula hoop or large model of a circle made of construction paper, pretend the class is at a rodeo. Place the hoop or "paper circle" on floor or table. Have enough of the small rubber or plastic cowboys, women, children, and men in other occupations in a bag so that each child may reach in and quickly pull out one figure. He will then play the part of the figure. The cowboys can go inside the circle with the horses to be ridden, some of the children can sit on the circle fence, and the others can stand where they wish outside the circle while the rodeo is in progress.

In another "Let's Pretend" game, the children might go to the circus. Small plastic or rubber circus animals could be put in a bag and each child would act the part of the animal he pulled from the bag. Each animal would go inside the circus ring as it was his turn to perform. The rest would watch from outside the ring.

Many singing games call for a circle. Call attention to the group in the circle, the child who is inside the circle, and those who are outside the circle. Some of the games are: "Froggie in the Middle," "The Farmer in the Dell," "Bow Belinda," "In and Out the Window," "Lobby Loo," " The Old Brass Wagon," and "Hokey, Pokey."

Circle games can be used in the same manner; e.g., "Duck, Duck, Goose" and "Drop the Handkerchief."

I-3. Comparison of Sets

Objective: To compare sets by pairing their members and describing the result with the terms more than, fewer than, and as many as

The following activity may be used in preparation for a walk.

Vocabulary: Pair, more than, fewer than, as many as

Materials: Labels for children's storage areas, paint brushes, paint jars, paper, easel, crayons, tools, name cards, flannelboard objects, paper clips, buttons, bottle caps, blocks

Activities to Help Develop These Concepts:

The teacher should place herself in a central location with the boys on one side and the girls on the other. Then, she may pair a member of one set (the set of boys) with a member of the other set (the set of girls). This procedure can be used to determine the partners for a walk.

Suppose Jack and Mary are partners. The teacher may ask,

"Jack, name the member from the set of girls who is your partner."
"Mary, name the member from the set of boys who is your partner."

When all have been paired, she may ask,

"Does every member of the set of girls have a member from the set of boys as a partner." "Does every member of the set of boys have a member from the set of girls as a partner."

If the answer is "yes" to both questions, then there are as many boys as girls in the class. If the answer is "no" to one of the questions, then there will be more members in one set than in the other and one set has fewer members than the other.

Use other daily activities to illustrate pairing the members of one set with members of another set. For example, pair the pupils with sheets of paper for art activities, or with easels, rhythm instruments, toys, etc., asking, "Is there a sheet of paper for each child?"; "Is there a child for each sheet of paper?" And, "Is there a child for each instrument (or toy)?" "Is there an instrument (or toy) for each child?"

Class parties offer a wealth of opportunities for pairing: favors with refreshments, refreshments with place mats, place mats with pupils, etc.

Prepare for games, dances, etc., which require teams with the same number of members on each team. Pair a member of one team with a member from the other team to see if there are the same size teams, or if one team has more or fewer members than the other.

More Than, Fewer Than

Deomonstrate to the children that we can see which set has more members by pairing one member of each set with a member of the other set. Do this with the children. When the pairing is complete, tell which set has more members and which set has fewer members.

Put a set of bottle caps with many (20 - 30) members on the floor where all can see. Place another set with a few (2 - 4) members on the floor near it. Ask the children if one set has more members than the other. If the children choose the correct set, ask the children why they chose that pile. If a child responds, "It is bigger," substitute some very large blocks for the set with few members and ask again which set has more members. We say the set of beans or blocks has fewer members than the set of bottle caps. The set of bottle caps has more members than the set of beans or blocks.

Place a set of paper clips and a set of buttons, each with nearly the same number of members (8 - 10) on the floor. Ask the children which set has more members. There might be some disagreement.

> Look at the set of children in the room. Look around the room. Does the set of blocks have more members than the set of children? Pair the members of these sets if necessary. Can you find a set that has fewer members than our set of children? Can you find one that has more members than our set of children?

Place a set of four flannelboard objects on the flannelboard. Tell the children to think of a set of story book people whose members are Jack Horner, Little Boy Blue, and Little Bo Peep. Ask the children if the set of flannelboard materials has more or fewer members than this set of story book people.

> How can we pair the members of a set we can see with the members of one we cannot see?

As you name each story book person, have some member of the class remove a flannelboard object.

Did we have a story person for each thing on the flannelboard?

Which set has more members?

Which set has fewer members?

Comparing Imagined Sets:

Each of us sees many pictures in his mind every day.

Today I'm going to tell you what I want you to see.

First, think of a robin's nest with eggs. Now think of an apple tree full of apples. Which set has more members, the set of robin's eggs or the set of apples?

Next, think of a little yellow chick looking for a bug. Now think of a spider walking along the ground. Which has more legs, the chick or the spider?

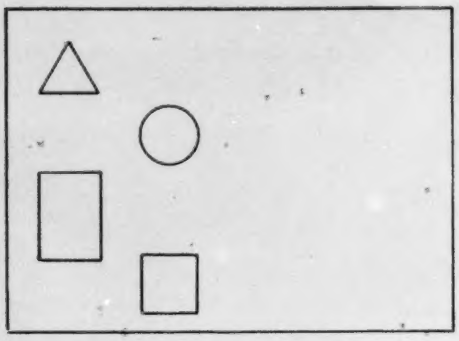
Think of the leaves on a tree. Now think of the leaves on a tulip. Which has more leaves, the tulip or the tree?

Many other comparisons which will be familiar to the children may be used. Some other suggestions are:

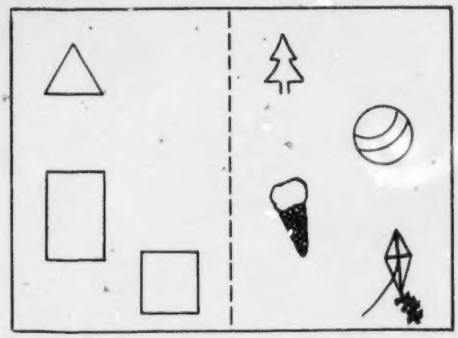
1. The lights on a Christmas tree and the lights on a floor lamp.
2. The wheels on a truck and the wheel on a wheelbarrow.
3. The boots belonging to all the children in our room and the boots belonging to the children in your family.
4. The candles on your birthday cake and the candles on your father's birthday cake.

As Many As:

Select a child to place a set of objects on the left side of the flannelboard. (See Picture 1) (Limit the amount to be used to a handful or fewer since two sets will have to be paired.) Have the class describe the set. On the right side of the board the teacher is to place another set with as many members as the first set. Have this set described too.



Picture 1

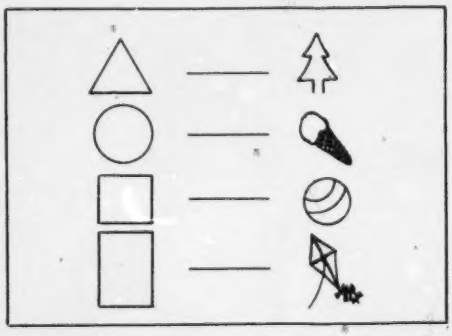


Picture 2

We now have two sets on our flannelboard (indicate). (See Picture 2) Let's see if there are as many members in one set as there are in the other.

(Yes, we can pair the members of one set with the members of the other.)

"Johnny, will you pair the triangle with a member of the set on the right?" Place the pair of members in the center of the flannelboard. (Repeat this process with several pupils until all the members are paired.) (The pairings may be emphasized with a strip of felt or a piece of string connecting the paired members.)



Picture 3

Did we use all the members of one set with the members of the other? (Yes) Yes, we paired all the members of the set at the left with the members of the set at the right. There were as many members in one set as in the other.

Now, Bill and Kathy, will you please play this game? Bill, you can make a set on the flannelboard. Now, Kathy, will you make a set and pair its members with those of Bill's set? (Repeat this game as long as interest is held.)

Pass out individual set boxes or set materials to each child. If a rug is available, children can sit along the edge and face in toward the center. The set materials should be placed in front of them so they may readily be seen by the teacher. Each box should contain 2 types of set materials: e.g., animals and geometric shapes.

Now that we all have our boxes, let's open them and see what's inside.

What different kinds of objects did you find? (To be named.) Yes, we can say there's a set of sticks and a set of counters.

Take out all the members of the set of sticks and place them on the right side of the box.

Now take out your set of counters (or disks). Please place them on the left side of the box.

I will help you by putting sets like yours on the flannelboard. Do you think that the set of sticks has as many members as the set of disks? Let's pair the members of one set with the members of the other and see.

After the pairing, note that all the members of each set were used. Therefore, each set has as many members as the other. This activity may be used during free time. Children might enjoy creating sets of their own. Simple sets can be made from: shapes of various colors of construction paper, pegs from peg boards, beads, pieces of yarn, etc.

Place five chairs in a row. Select five children and ask them to be seated in the chairs. Point out that the children are paired with the chairs and that there are as many children as there are chairs, and there are as many chairs as there are children.

Ask children "to prove" to you that they have as many fingers on one hand as on the other; stress that they cannot count the fingers but must <u>show</u> you. If needed, suggest that they pair their fingers by putting the finger tips

from opposite hands together. Thus, each finger is paired and there are no fingers not paired. The set of fingers on the left hand has as many members as the set of fingers on the right hand.

Have the children create pictures of equivalent sets and draw lines between the members to show that the sets are equivalent.

Provide further experiences in pairing members of sets. On some occasions be certain that there are more (fewer) members in one set than in the other. On other occasions there should be just as many members in one set as in the other.

I-4. Subset

Objective: To introduce the idea of subset of a set

Vocabulary: Set, subset

Materials: Variety of set materials and flannelboard objects
Colored construction paper; several sheets each a different color
Jar of multi-colored beads
Rhythm instruments
Set of play dishes

Activities to help develop these concepts:

Will each member of the set of children in our room raise one hand?

Do all the boys have one hand up? (Yes)

Do all the girls have one hand up? (Yes)

Everyone put his hand down.

Now, let's have each member of the set of girls stand. Is Patty a member of the set of girls? (Yes) Repeat this question about several girls; then ask the question inserting a boy's name.

Is Michael a member of the set of girls? (No) Michael is not a member of the set of girls. Of what set is he a member? (The boys) Will the set of boys stand? (Repeat as with the girls)

We have seen that there is a set of children in our room. We also know that there is a set of boys and a set of girls. We say that the set of girls is a subset of the set of children because every member of the set of girls is a member of the set of children. The set of boys is a subset of the set of children because every member of the set of boys is a member of the set of children.

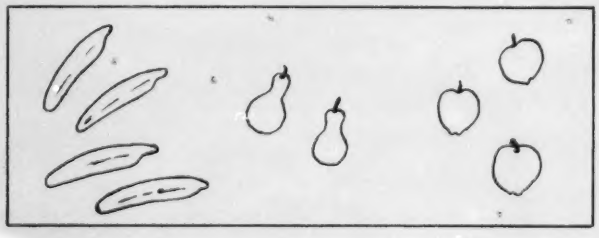
Boys, will you please stand? (Ask three to raise their right hands.) Bob, Danny and Steve have raised their right hands. Are these three boys members of the set of all the boys in our class? (Yes) Can we think of them as a set within the set of boys? (Yes) They have their hands raised. We call these boys (pointing to three boys) a subset of all the boys in our class.

Repeat the above process with the girls: set of girls and set of girls holding books; or the set of girls and the set of girls wearing white shoes, etc. Further develop the idea using the entire set of children and identifying subsets of this set, e.g., children who are today's helpers. Continue the lesson as needed by selecting extended activities from below.

Caution: It is necessary to identify the set first before talking about a subset of that given set. We do not start with a subset and then think of a set.

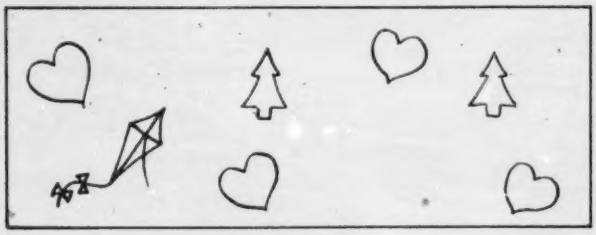
Place a set of objects on the flannelboard, e.g. apples, bananas and pears. Have the children describe the set of fruit.

Ask a child to come to the flannelboard and place all the members that are alike together thus making several subsets.



Do we still have the set we started with? (Yes) What subsets have we found in the original set? (Bananas, pears, and apples.) Repeat the process with a variety of objects. Show that subsets do not necessarily need like members by rearranging the like members into other subsets, e.g., a banana, apple, and a pear for one subset.

In one instance, select the objects with several like ones and one being dissimilar to any other; hearts, trees and a kite.



Have the children separate the collection or set into subsets of like members. One subset will have just one member. The children can identify this.

Select an object that is not present on the board and ask what type of set it is.

Who can describe the set of stars on the board? (There are no stars; it's the empty set.)

Begin talking about all the children in the school as one set. Break this set down into subsets of each class or classroom. These sets in turn have various one-member subsets; the set of all girls named Patricia Smith, the set of all boys named John Jones.

Refer to an imaginary family and create subsets of mother, father, and children; mother and father each being one-member sets. You may extend this to include a subset with no members.

Place several blocks of various colors (or crayons, sheets of construction paper, etc.) on a table. Have the set described. Invite the children to identify the various subsets (red blocks, yellow blocks, etc.) Ask if the red blocks are members of the set of blocks; if the yellow blocks are members of the set of blocks, etc.

If classroom "helpers" are used, all of the helpers can be considered as a set of helpers. Identify the subsets of this set. (e.g., the helper(s) who waters the plants in the room.)

Refer to the buildings in a town as the set of buildings in our town. Identify the subsets. (e.g., houses, offices, hotels, stores, libraries, etc.)

In addition to separating the class into boys and girls, you may separate into subsets of: children with curly hair; boys wearing red; girls wearing green; children with tie shoes; those who want to work in certain work areas during free time, etc.

Talk about the set of dishes used in the playhouse. Describe the original set and identify the various subsets, e.g., cups, saucers, etc. Use the actual dishes for demonstration purposes.

If orange juice cans are brought in by the children for paint and other purposes, gather several of these together and form a set. Talk about the different labels and make subsets of the like brands. This same idea may be used if the classroom has a "store" in it with several different types of cans. These cans may be arranged in subsets according to size, type of food, brands, etc.

Decorate crackers or cookies with such things as raisins, coconut, walnuts, and chocolate chips. The cookies can then be arranged into subsets according to the decoration, e.g., raisins, raisins and walnuts, chocolate chips, etc.

Identify various subsets within a set of multi-colored beads.

Select rhythm instruments for music by separating the set into subsets of triangles, drums, etc.

I-5. Joining and Removing

Objectives: To introduce the operation of joining and its commutative property

To introduce vocabulary and meaning for removing a set and the meaning of remainder set.

Vocabulary: Join, union, remove, remainder

Materials: Cows and sheep from small, wooden farm animal set, rectangle blocks, cars, trucks, trains, doll buggies, set material in five sacks, perception cards, chart holder

Activities to help develop these concepts:

Have the sheep and cows identified as the sets to be used today.

You have had fun using these small wooden farm animals and the blocks. Today, let's pretend these blocks which I'll put on the rug will form a fence around a pasture. We'll put the sheep into the pasture. Mr. Brown, the farmer, has milked his cows this morning and is now taking them to the pasture to join the sheep.

Bill, will you please open the gate so that the cows can join the sheep?

When we join one set with another, we form a new set.

What are the members of this new set? (Each member of the set of sheep and each member of the set of cows)

During the daily activities, there will be many opportunities to have one set joined to another. e.g.:

1. one set of picture books to another set of picture books
2. one set of toys to another set of toys
3. one set of blocks to another set of blocks
4. a set of sand shovels to a set of sand pails
5. a set of new brooms to a set of mops
6. a set of new games to the set of old ones in the cupboard

Put the wheeled toys together in a group and ask to have the set described.

Show the set of cars without moving them from the larger set.

Is this set of cars a subset of these wheeled toys? (Yes)
Can we remove these cars from the set of toys? (Yes)

Pull the cars to one side but do not take them entirely away.

What set do we have remaining here on the rug?
(The other wheeled toys)

We call this the remainder set. The remainder set is the set that is left when we remove a subset from the original set.

During the regular classroom activities, there will be many opportunities to use and reinforce the concepts of remove and remainder sets. Some such areas are:

Children in the room can form the original set. A set removed can be those children going to a work area for the free activity period. Other children are members of the remainder set.

Children on their rugs at rest time can form the original set, a set removed can be described as children who are asked to put away their rugs.

Subsets can be removed from the original set of children at dismissal time, calling attention to the set removed and the remainder set.

I-6. Ordering

Objective: To introduce ordering of sets by using ideas of more than and fewer than

Vocabulary: More than, fewer than

Materials: Small objects, paper bags, perception cards, chart holder

Activities to help develop these concepts:

Put small, familiar objects (from 1 through 5) in paper bags. Place the bag at random on the floor so that neither you nor the children know which bag holds a particular set. With all children facing a low table, or other area easily seen, pick a bag and place its contents in the center of the table. Ask a child to choose another bag, remove the set, and determine whether or not it has more or fewer members than yours. If his set has more members, have him put it on the right of the set on the table. You may wish to put these objects on colored paper or cards to help children identify the members of each set. If it has fewer members, place it to the left. Be sure that all children are sitting so that the directions, left and right, are correct from their viewpoint. Put the objects back in the bags and repeat the procedure several times. Do not count the sets at this time. If a child cannot determine whether the set has more members than or fewer than the set on the table, ask him to check by pairing the sets. Then repeat activity by continuing to arrange sets in order of number of members. For example, after the first set selected is placed to the right or to the left of the starting set, have another child select another. It may go between the first two or to the left of one or to the right of the other.

Prepare perception cards from 1 through 5. Place face down in a box. Pick one card at random to put into the center of the chart holder. Ask a child to pick out another card and determine whether the set on his card has more or fewer members then are in your set. If his set has fewer members, have it placed to the left of your card. If it has more members, ask that it be placed to the right. Again, check to see that all children are sitting so that the directions, left and right, are correct from their viewpoint.

Using the perception cards, the teacher will pick a card from the box for the beginning of the game. A child will then pick another card and without looking at it place it either to the right or left of the first. This child will then ask another child if he has placed it correctly. If he did not, the

second child will tell him why it is not correct and move the card to its right position. The second child then removes all sets and starts the game with a new card picked at random. (When the second child does not know if the set has more than or fewer members, ask him to check by pairing the members of the sets.) Again, arrangements can be made by continuing to draw cards without replacements as was suggested for the objects in paper bags.

1-7. Using Geometric Shapes for Directions and Games

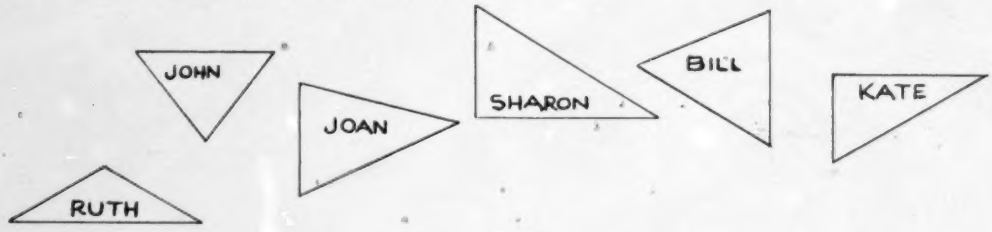
Objective: To provide added opportunities for the children to see geometric shapes in different positions and under varying circumstances

Vocabulary: Between

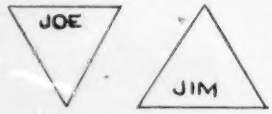
Materials: Colored construction paper cut into geometric shapes, wire models, various shaped boxes, string, yarn, objects for "houses" and "people," large kindergarten beads, chairs, tables, direction arrows, collage

Activities to help achieve desired results:

If there are times when the teacher wants children to sit in designated places around the rug, the names can be put on geometric shapes, made of colored paper. This affords another opportunity of seeing these shapes in different sizes and in different positions, e.g.,



Use the rectangles and circles in the same way. These shapes may also be varied as to size and color.

Have various shapes made with the name of a child written on each shape. (e.g., triangles - 

, etc.)

Put these shapes name down on the rug or a nearby table.

> Today we will have a different way of deciding where children will work. As you have already noticed, there is a piece of paper shaped like a triangle by the big blocks, one the shape of a rectangle by the art materials, one the shape of a circle by the small blocks, etc. As the shape with your name is turned over, please go quietly and stand in the area marked by the shape that is just like yours.

This is a good way of seeing that some children work in areas that they choose. At a later time, these same shapes can be used to get the children working in yet another area.

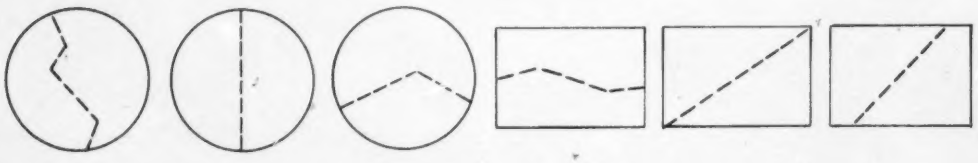
Puzzle Box of Shapes

Make heavy cardboard cutouts of rectangles (including squares), triangles, and circles of various sizes. Cut these irregularly into two, three, or even four pieces to be fitted together to complete the figure. These pieces could also be used as a game to find out who would work in the various areas during the free activity period. After each child has taken a piece from the box, designate one child as the "key" man for each shape. He stands in one place holding his piece so that it can be seen easily. The other children see how quickly they can find where their piece of the puzzle fits. They have then unlocked the answer to name the children with whom they will work. The teacher next helps them to find where they will work by holding up the shape to match the one formed by putting pieces together.

> The children whose set forms the "red square" will use the big blocks. The children whose set forms the orange triangle work at the easel, etc.

Games with Shapes

Have colored shapes cut into two parts. e.g.:



Place one of each of the parts on a table and keep the other. Each child picks up one part of the shape as he is ready to enter the group situation and puts it in front of him on the rug. His turn to "share" with the class will come when the teacher holds up the part of the shape that will fit with the part on the rug in front of him. If he does not have anything to share, he may match the second part and sit down.

"What is Missing" Game:

Put four shapes in a row on the flannelboard. Have the children name the shapes in order from left to right. As they close their eyes, the teacher removes one of the shapes. One child must tell which shape is missing. This may be continued for a few minutes using different arrangements of the shapes.

Geometric Relay:

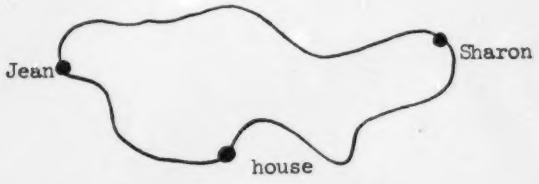
Divide the class into three or four teams. Seat (or stand) teams in rows on the rug. The teacher will show a geometric shape, allow the first child in each team a minute or two to find another shape like it somewhere in the room, ring a bell, and as soon as the first child sits at the back of his row, show another shape for the new leaders of each row to find. This continues until each child has had a turn. The team whose members were able to find all or most of the shapes in the allotted time wins.

The teacher may use felt or paper shapes and have children hunt like shapes or she may use the felt shapes and ask the children to find objects such as blocks, hoops, wire models, etc., that have edges shaped like rectangles, squares, circles, and triangles.

Between:

Later in the year, many of the children will be ready for and enjoy "maze" games.

Using string or yarn, make a simple closed curve on the rug -- large enough for all the children to see easily as they sit around the rug. At one spot around the curve, place some object to represent a home. Using two of the small wooden or plastic set of people, call one (Jean) and the other (Sharon). Put these two at different spots on the curve. e.g.,



This is Jean and this is her home.
Can Jean go home without passing Sharon?
Show me how she could do it.

Let the string or yarn lie at random on the rug forming a path. Place "Jean" at one end of the path and her home and a tree at the other. Somewhere between put another "house" for "Sharon."

Jean is taking this path to get to her home which is over by the tree. Sharon lives in this new house. Can Jean follow the path to her home without going past Sharon's home?

Show me.

Another way of showing this form of a maze is to use large kindergarten beads on the simple closed curve made of string or yarn. Tie a large blue bead at one spot on the curve and have one red and one green bead strung on the string. Again, use enough string so that each child can see it easily from his position on the rug.

Can you move the red bead to the blue bead without touching the green one?

Show us the path you will need to follow.

If you move the red bead in the opposite direction, is the green bead between you and the blue one?

Show us.

There are many opportunities to reinforce the concept of "between" both in the room and on the playground.

The teacher may use one or more of several ways to enable the children to "see" the playground. Looking at it from the window, seeing it in the mind's eye, using objects in the room to represent the permanent playground equipment, or using the flannelboard materials to show the placing of the equipment.

slide

sandbox

seesaw

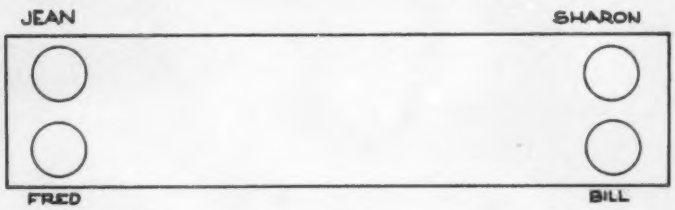
When Bill goes down the slide, does he have to go past the sandbox to get to the seesaw? Is the sandbox between the slide and the seesaw?

slide

tile

garden

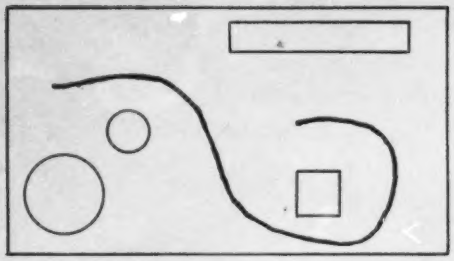
When Jean goes down the slide, does she have to go past the garden plot to get to the tile? Is the garden plot between the slide and the tile? Is the tile between the slide and the garden plot?



If I serve the milk to Jean first, do I have to go past another child before I can serve Bill? Is there someone between Jean and Bill no matter which way I go around the table?

Following the maze while marching to music can add to the interest as well as vary the procedure. Chairs, room dividers, tables, etc., may be used for the maze walls. Arrows pointing toward the direction to be followed at the turns add fun and keep a smooth flowing line of children.

Create collages with various shapes and degrees of sizes within these shapes, strings, etc. Discuss the finished pieces of work such as:



Which is the bigger circle?
What shape has the string around it?
What two shapes are right next to each other?
The string goes between what shapes?

Use perception cards, flannelboard materials and construction paper to make visual aids such as the following:

Ask such questions when displaying one, two or more of the above:

In which one do we see a triangle inside a square?

Which triangle has a rectangle outside of it?

Which of these have a triangle inside another shape?

Select two pictures that are alike. (Note: make duplicates of some illustrations.)

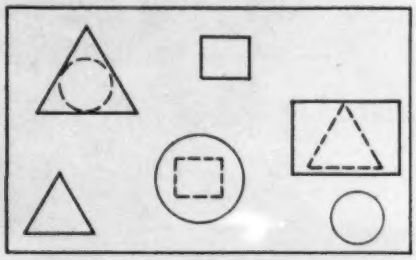
Make felt or construction paper shapes and cut out different shapes from the inside. These can be used to fit into each other.

Use questions such as the following:

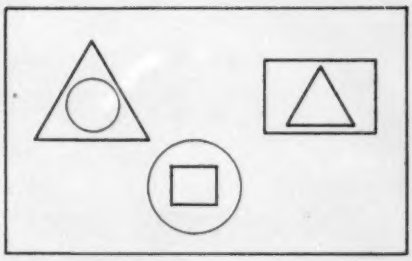
Which triangle fits inside the large rectangle?
Which square fits around the green circle?
Which circle fits around the yellow circle?

The flannelboard display may appear as below:

(1)



(2)



Make several geometric shapes (felt for use on the flannelboard is very effective.) These should be of graduated sizes.

With the above, direct the children to do the following:

Place the largest triangle on top of the largest circle.

Put the smallest triangle inside the largest square.

Arrange the largest triangle between the smallest circle and square.

(The teacher and child can create as many situations and have fun while following directions.)

I-8. Using Numbers with Sets

Objective: To help the child identify the number of members in certain sets. (These sets will be limited first to no more than 5 members. Some groups and some children will be ready to think about sets with more than 5 members. Yet, we ask these be limited to no more than 10 members.)

Vocabulary: No new terms

Materials: Set objects, flannelboard materials, perception cards

Activities to help develop these concepts:

There are many opportunities in the daily program for the child to recognize, with or without counting, the number of members in small sets. (Although the following activities use only sets with few members, the teacher may extend these activities to include sets with more members if she feels her children are ready.)

In some kindergartens, certain work areas are limited to 4 children at a time. A child soon is able to see at a glance whether or not there is room for him on the big blocks, in the dollhouse, at the workbench, etc.

Singing in duets, trios, and quartettes help him to see 2, 3, or 4 in another situation.

Six children may sit at each table at lunch time, three on a side.

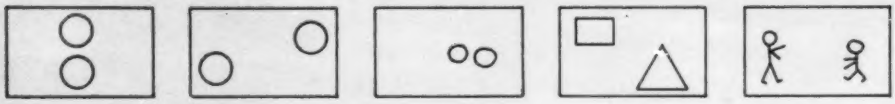
There may be 4 pictures on a bulletin board which he might see as 2 and 2, or 4.

When the set of girls with curly hair stands, there may be 3 in one place and 1 in another which the child can see as 4.

Set materials, the flannelboard, and perception cards may be used to help the child realize that 3 members in a set are 3 no matter the size, arrangement, or objects used.

Arrange in various ways on the rug, 3 large blocks, 3 marbles, 3 balls, 3 paint brushes, and 3 small toys. Help the child to see that the objects, the arrangement, or the size did not change the fact that each set had 3 members.

Perception cards might be used. e.g.,



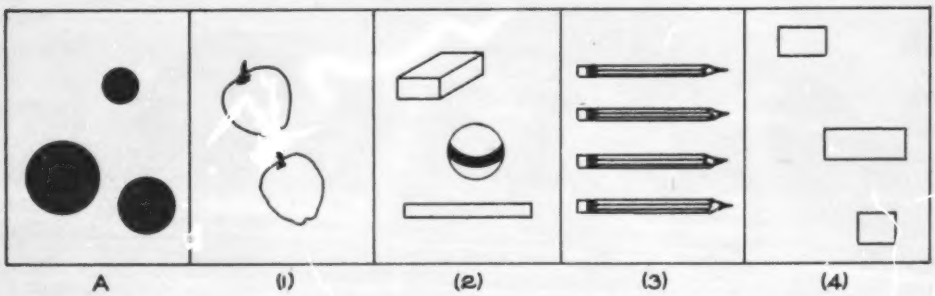
Before the children come in, place small set materials around the room. Have materials that you can use to arrange in sets of 2, 3, 4, or 5. It may be best to use a variety of set objects in your arrangement to reinforce the idea that sets may be made of dissimilar members.

> I have a set of (describe set). I would like you to find a set that you can arrange just like mine.
>
> Sometimes we talk about things that come in twos. We call the two shoes we wear a <u>pair</u> of shoes.
>
> Can you think of other pairs?

Talk about clothing that comes in pairs: mittens, shoes, boots, etc.

Create a game or activity using the parts of the body that are paired: eyes, ears, lips, shoulders, arms, hands, hips, legs, knees, ankles, and feet.

Using a flannelboard materials, perception cards, or felt pen on newsprint, arrange a set of three objects and at least three other sets so that one set matches the first one. Ask a child to find the set that matches the first set. For example, sets of objects might appear as illustrated below where sets 2 and 4,



are shown to be equivalent (matched and found to have as many members as A and A to have as many members as 2 and 4.

Use other sets of objects in the same way with fewer and with more members. Then ask children to find sets of objects in the room that will match the one

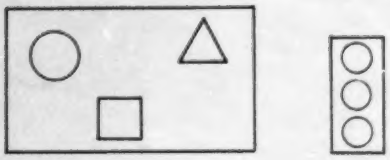
that is the model set. Have them pair the members of their set with the members of yours to see that one set has just as many members as the other. Be certain that children do not get the idea that the members of a set do not have to be like objects or that they must be arranged in the same way.

Rhythms and counting beats to the music offer many opportunities to create sets that are intangible. This will be a change from the normal perceptual sets. The music transmits feelings of movement for the body such as skipping, stepping, jumping, walking, etc. The faster tempos are counted quickly and often suggesting running; slower tempos of 1, 2, 3 suggest walking. By responding to the counting we create the music or patterns of movement such as walking to the "1, 2; 1, 2; 1, 2" of the "Amaryllis." Marching develops from the "1, 2, 3, 4" of marches like "Yankee Doodle." For variety play something of 3/4 time such as the "Skater's Waltz." Ask if the children could march to this music. (No) Tap out the beat possibly using the rhythm sticks in a swinging motion. Tap the floor each time "one" is counted. Gallop music and lullabies such as "Rock-a-bye-baby" make use of the 6/8 time.

Individual rhythm instruments may be used to count. The beats of a drum, triangle, etc., can be listened to and the children may return the same number of beats by clapping their hands. This can also be done by having one child create a set pattern and then ask the children to tell which number they thought of from that set of beats. Variation can be achieved by changing the tempo.

Use perception cards illustrated in the list of Materials at back of book for set description of various types:

1. Recognizing sets with 1, 2, and 3 members.
2. Using sets of 2 and 3 members to describe larger sets (a set of six members is made up of two sets of three members each or three sets of two members each, etc.).
3. Identification of subsets within sets.
4. Pairing members of two sets and discovering that one has as many members as the other or more than or fewer than the other.
5. Joining sets of few members and creating a new set; removing a subset to find the remainder set.
6. Recognize that a set made up of three members arranged in a large area represents the same number as a set of three members within a small area.



7. Identify two sets which have the same arrangment of members, as well as the same number of members.

MATERIALS

The following list of materials contains suggestions for visual aids helpful in the mathematics program. It is not exhaustive by any means and the teacher may find other materials to use. Also, not all of those listed are necessary.

MATERIALS FOR TEACHER DEMONSTRATION AND PUPIL USE

General classroom supplies: paper clips, rubber bands, furniture, paint brushes and paint, crayons, etc.

Flannel board

Flannel board objects: geometric shapes, animals, etc.

Toys: dolls, cars, dishes, plastic animals, stand-up figures, doll clothes, etc.

Balls: a variety of sizes ranging from golf to beach

Rhythm instruments

Blocks of all shapes and sizes

Lincoln logs

Seasonal materials: Indian corn, pumpkins, Christmas decorations, etc.

Games: dominoes, object lotto, puzzles, etc.

Paper sacks

Boxes of various sizes and shapes

Perception cards

Empty cans of various sizes

Oatmeal box

Embroidery hoop

Plain ring: Hula Hoop if available

Cookie or donut cutter

Wire models of geometric shapes

Coins

Sandpaper cut-outs of geometric shapes

Balloons

Books

String and yarn

Umbrellas of various sizes

Old Magazines

(Note the list of "Individual Set Materials" and use as applicable)

INDIVIDUAL SET MATERIALS

Bottle caps

Buttons

Pegs

Beads

Construction paper shapes

Crayons

Macaroni shells

Beans

Small toys: animals, cars, cowboys, surprises from cereal boxes, etc.

Tongue depressors

Corks

Straws

String and yarn

Marbles

Spools

Paper and wooden discs

Rocks

Shells

Plastic spoons and forks

One-inch-square wooden cubes

"Food for thought and stomach": marshmellows, cookies, crackers, etc.

General room supplies

Set containers: boxes, cottage cheese cartons, paper bags, envelopes, etc.

MISCELLANEOUS IDEAS

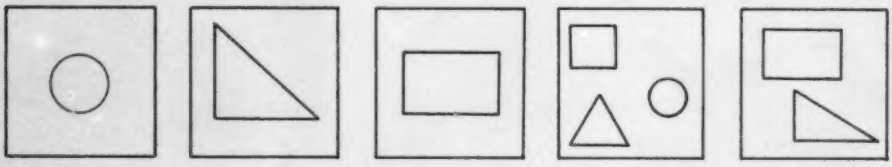
Individual set boxes: These may be made from any materials available. They have proven very useful in set manipulation done by the pupil. The following ideas have been suggested:

1. Boxes of various sizes which are convenient to store. If one wishes to, felt or flannel may be glued in the inside lid and thus create individual flannel boards for each pupil. Place the objects for use inside the box and children may manipulate these such as directed or during free-time activities.
2. Cottage cheese cartons are easily obtained and very good for storage. Use small individual set materials such as: beads, pegs, paper discs, bottle caps, etc. These may be stored inside the cartons as they are stacked.
3. Paper sacks of various sizes to accomodate almost any individual set material desired. These can be used with an element of surprise: grab bag.

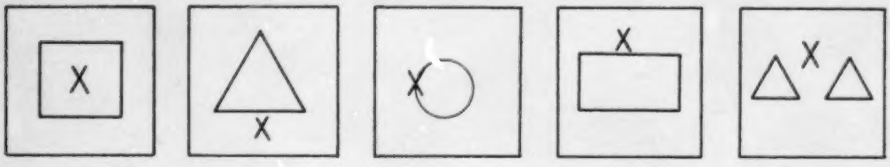
Perception cards: These aids showing sets of various members are excellent sources for reinforcing concepts and vocabulary. The cards may be made by the teacher for demonstration purposes and also by the children for class work. The latter individual cards are particularly valuable when working with "pairing, more than, larger than, same as, etc." By keeping a variety of cards, the children will not tend to memorize the answers sought. At the same time interest and intrigue may result from the element of surprise. Some suggestions are listed below:

1. Pictures of sets from magazine advertisements, story and picture books. Mount these on heavy tagboard for demonstration purposes.

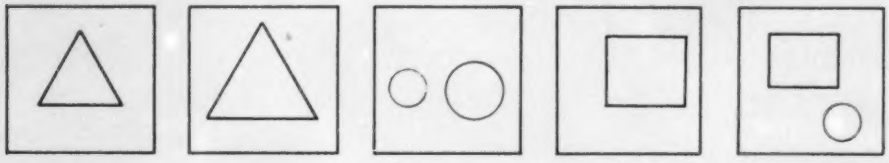
2. Geometric shapes (individual and combinations) such as circle, triangles (three types), rectangle and square.



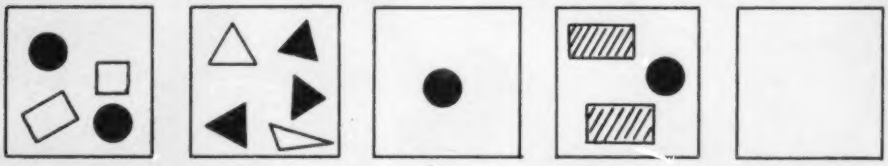
3. Various objects, such as geometric shapes with an "X" placed in various positions to show "inside, outside, over, between, etc." For example: make a square and mark an "X" inside of it. Ask the children where the "X" is located.



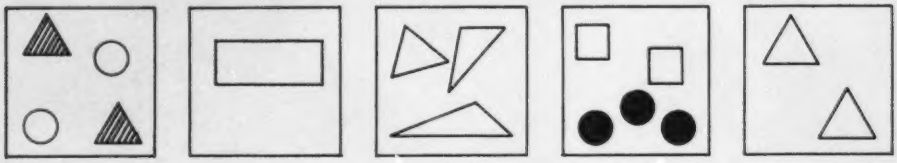
4. Smaller and larger figures to show comparison of size; individual or a complex group.



5. Sets of dots, geometric shapes and other objects to compare set sizes (include a blank card depicting the empty set.)



6. Sets which can easily be partitioned into subsets of like members, one member sets, etc.



BIBLIOGRAPHY

Children's Books Related To Mathematics

Beim, Jerrold. Country Garage. New York: William Morrow and Co., 1952.

Berkley, Ethel S. Ups and Downs. Eau Claire, Wisconsin: E. M. Hale and Co., 1951.

Bianco, Pamela. The Doll in the Window. New York: Henry Z. Walck, Inc., 1953.

Bishop, Claire Kutchet. The Five Chinese Brothers. New York: Coward-McCann, 1938.

Borten, Helen. Do You See What I See? New York: Abelard-Schuman, Ltd., 1950.

Budney, Blossom. A Kiss is Round. New York: Lothrop, 1954.

Brann, Esther. Five Puppies for Sale. New York: The Macmillan Co., 1948.

Corcos, Lucille. Joel Spends His Money. New York: Abelard-Schuman, Inc., 1954.

d'Aulaire, Ingri. The Two Cars. Garden City, New York: Doubleday and Co., Inc., 1955.

d'Aulaire, Ingri, and d'Aulaire, Edgar Parin. Don't Count Your Chicks. Garden City, New York: Doubleday and Co., Inc., 1943.

Duvoisin, Roger. Two Lonely Ducks, A Counting Book. New York: Alfred A. Knopf, Inc., 1955.

Emberley, Ed. The Wing on a Flea. Boston: Little, Brown, and Co., 1961.

Falconer, Rebecca. Tall-Enough Tommy. Chicago: Childrens Press, Inc., 1954.

Friskey, Margaret. Chicken Little Count-to-Ten. Chicago: Childrens Press, Inc. 1946

Friskey, Margaret. Seven Diving Ducks. Philadelphia: David MacKay Co., 1940.

Geisel, Theodor Seuss (pseud. Dr. Seuss). The 500 Hats of Bartholomew Cubbins. New York: Vanguard Press, 1938.

Geisel, Theodor Seuss (pseud. Dr. Seuss). One Fish, Two Fish, Red Fish, Blue Fish. New York: Random House, 1960.

Hall, William. The Seven Little Elephants. New York: Thomas Y. Crowell Co., 1947.

Ipcar, Dahlov. Brown Cow Farm, A Counting Book. Garden City, New Yor'. Doubleday and Co., 1959.

Jackson, Kathryn. Wheels. New York: Golden Books. Simon and Schuester, 1952.

Kay, Helen. One Mitten Lewis. New York: Lothrop, Lee, and Shepherd Co. Inc., 1955.

Kipling, Rudyard. The Elephants Child. Chicago: Rand McNally, 1955.

Krauss, Ruth. The Growing Story. New York: Harper Brothers, 1947.

Kravetz, Nathan. Two for a Walk. New York: Henry Z. Walck, Inc., 1954.

McCall, Adeline. Timothy's Tunes. Boston: Boston Music Company, 1948.

Meeks, Esther. One is the Engine. Chicago: Wilcox and Follett Co., 1952.

Moon, Grace and Carl. One Little Indian. Chicago: Albert Whitman and Co., 1952.

Osswald, Edith, and Reed, Mary M. The Golden Picture Book of Numbers. New York: Simon and Schuster, 1954.

Pease, Josephine Van Dolzen. One, Two, Cock-a-Doodle Doo. Chicago: Rand McNally Co., 1950.

Podendorf, Ila. The True Book of Pets. Chicago: Childrens Press, 1954.

Schlein, Miriam. Fast Is Not a Ladybug. New York: William R. Scott, Inc., 1953.

Schlein, Miriam. Heavy Is a Hippopotamus. New York: William R. Scott, Inc., 1954.

Schlein, Miriam. Shapes. New York: William R. Scott, Inc., 1952.

Schneider, Herman and Nina. How Big Is Big. New York: William R. Scott, Inc., 1946.

Seignbosc, Francoise. Jeanne Marie Counts Her Sheep. New York: Charles Scribner's Sons, 1951.

Skarr, Grace. All About Dogs, Dogs, Dogs. Eau Claire, Wisconsin: E. M. Hale and Co., 1954.

Slobodkin, Louis. One Is Good but Two Are Better. New York: Vanguard Press, Inc., 1956.

Smock, Nell S. Little and Big. Nashville, Tennessee: Abingdon-Cokesbury Press, 1947.

True, Louise. Number Men. Chicago: Childrens Press Inc., 1948.

Tudor, Tasha. 1 is One. New York: Henry Z. Walck, Inc., 1956.

Watson, Nancy. What Is One. New York: Alfred A. Knopf, 1954.

KINDERGARTEN VOCABULARY

above
alike
behind
below
beside
between
big
bigger
biggest
bottom
center
close
closer
closest
collection
corner
different
edge
empty set
fewer than
fewest
first
great
greater
greatest
high
higher
highest
in
inside
join
large
largest
larger than
last
long
longer
longest
low
lower
lowest
member
middle
more than
most
near
nearest
on
one
original
outside
over
pair
pairing
remainder set
remove
same as
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shape
short
shorter
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side
small
smaller than
smallest
square
subset
tall
taller
tallest
third
top
triangle
under
union